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## CASING FOR STORAGE APPARATUS AND STORAGE APPARATUS

### CROSS-REFERENCE TO RELATED APPLICATION

JP-A-2003-172536 applied on Jun. 17, 2003 in Japan is cited to support the present invention.

### BACKGROUND OF THE INVENTION

#### 5 FIELD OF THE INVENTION

The present invention relates to a casing for a storage apparatus and a storage apparatus.

### DESCRIPTION OF THE RELATED ART

10 It is desired that a storage apparatus used as a memory device in an information processing system is flexibly structured from a small-scale structure to a large-scale structure in correspondence to the needs of users.

15 Accordingly, a storage apparatus can be generally changed to a scale corresponding to the user's needs by structuring a drive unit for receiving a disc drive and a control unit receiving a control portion for executing a control of an entire storage apparatus as the independent casings, and adding the  
20 drive unit as occasion demands.

Further, in the case of the small-scale structure in which the number of the onboard disc drives is small, there is a case that the storage

apparatus is structured as an all-in-one unit in which minimum functions are received in one casing.

The apparatus structure mentioned above is described, for example, in JP-A-5-204493.

5           However, in the conventional storage apparatus, the casings for the control unit, the drive unit and the all-in-one unit are respectively manufactured for exclusive use. Accordingly, for example, in the case that the small-scale storage  
10 apparatus using the all-in-one unit is changed to the large-scale storage apparatus using the control unit and the drive unit, the casing for the all-in-one unit which has been employed can not be used. Further, since it is necessary to manufacture the different  
15 kinds of casing, a cost increase of the storage apparatus is caused.

#### SUMMARY OF THE INVENTION

The present invention is made by taking the problem mentioned above into consideration, and a main  
20 object of the present invention is to provide a casing for a storage apparatus and a storage apparatus.

In order to achieve the problem mentioned above, in accordance with the present invention, there is provided a casing for a storage apparatus  
25 comprising:

a first receiving portion for receiving a disc drive box in which a plurality of disc drives are

received in a line, the first receiving portion being approximately equal in height and width to the disc drive box; and

a second receiving portion for receiving a  
5 control portion box in which a plurality of control boards for executing a control relating to a data input and output process with respect to the disc drive are received in a line, the second receiving portion being approximately equal in height and width to the first  
10 receiving portion.

It is preferable that the casing for the storage apparatus is provided with a third receiving portion for receiving a power source portion for supplying an electric power to the control board and  
15 the disc drive, and the third receiving portion is provided in a lower portion of the second receiving portion.

Further, in accordance with the present invention, there is provided a storage apparatus  
20 comprising:

the casing for the storage having the structure mentioned above;

a plurality of the disc drives received in the disc drive box received in the first receiving  
25 portion;

a plurality of the control boards received in the control portion box received in the second receiving portion; and

the power source portion received in the third receiving portion.

Further, in accordance with the present invention, there is provided a storage apparatus  
5 comprising:

a plurality of casings for the storage apparatus having the structure mentioned above,

wherein in one of the casing for the storage apparatus, the disc drive box in which a plurality of  
10 the disc drives are received is received in the first receiving portion, the control portion box in which a plurality of the control boards are received is received in the second receiving portion, and the power source portion is received in the third receiving  
15 portion, and in the other of the casing for the storage apparatus, the disc drive box in which a plurality of the disc drives are received is received in each of the first receiving portion and the second receiving portion, and the power source portion is received in  
20 the third receiving portion.

In the storage apparatus mentioned above, it is preferable that the electric power to the control board and the disc drive by the power source portion is a direct current electric power having a uniform rated  
25 voltage.

Other objects, features and advantages of the invention will become apparent from the following description of the embodiments of the invention taken

in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a view showing an outer appearance structure of a conventional storage apparatus;

5 Fig. 2 is a view showing the outer appearance structure of the conventional storage apparatus;

Fig. 3 is a view showing a detailed structure of a control unit of the conventional storage apparatus;

10 Fig. 4 is a view showing a detailed structure of a drive unit of the conventional storage apparatus;

Fig. 5 is a view showing a detailed structure of an all-in-one unit of the conventional storage apparatus;

15 Fig. 6 is a view for comparing the control unit and the drive unit of the conventional storage apparatus;

Fig. 7 is a view for comparing a control portion box and a disc drive box of the conventional  
20 storage apparatus;

Fig. 8 is a view showing an outer appearance of a storage apparatus in accordance with the present embodiment;

Fig. 9 is a view showing the outer appearance  
25 of the storage apparatus in accordance with the present embodiment;

Fig. 10 is a view for explaining a detailed

structure of the storage apparatus in accordance with the present embodiment;

Fig. 11 is a view for showing a state in which a control portion box is received in a control unit of the storage apparatus in accordance with the present embodiment;

Fig. 12 is a view for showing a state in which a disc drive box is received in a drive unit of the storage apparatus in accordance with the present embodiment;

Fig. 13 is a view for comparing the control unit and the drive unit of the storage apparatus in accordance with the present embodiment;

Fig. 14 is a view for comparing the control portion box and the disc drive box of the storage apparatus in accordance with the present embodiment;

Fig. 15 is a view showing a detailed structure of the control unit of the storage apparatus in accordance with the present embodiment;

Fig. 16 is a view showing a detailed structure of the drive unit of the storage apparatus in accordance with the present embodiment;

Fig. 17 is a view for explaining a cooling structure for the control unit of the conventional storage apparatus;

Fig. 18 is a view for explaining a cooling structure for the drive unit of the conventional storage apparatus;

Fig. 19 is a view for explaining a cooling structure for the control unit of the storage apparatus in accordance with the present invention;

Fig. 20 is a view for explaining the cooling structure for the control unit of the storage apparatus in accordance with the present invention;

Fig. 21 is a view for explaining the cooling structure for the control unit of the storage apparatus in accordance with the present invention;

Fig. 22 is a view for explaining a cooling structure for the drive unit of the storage apparatus in accordance with the present embodiment;

Fig. 23 is a view showing a rectifier stack provided in the storage apparatus in accordance with the present embodiment;

Fig. 24 is a view showing the rectifier stack provided in the storage apparatus in accordance with the present embodiment;

Fig. 25 is a view for explaining a bus bar provided in the conventional storage apparatus;

Fig. 26 is a view for explaining the bus bar provided in the conventional storage apparatus;

Fig. 27 is a view for explaining a bus bar provided in the storage apparatus in accordance with the present embodiment; and

Fig. 28 is a view for explaining the bus bar provided in the storage apparatus in accordance with the present embodiment.

## DESCRIPTION OF THE PREFERRED EMBODIMENT

A description will be in detail given below of an embodiment in accordance with the present invention with reference to the accompanying drawings.

5 First, a description will be given of a summary of an outer appearance of a conventional storage apparatus 1100 with reference to Figs. 1 and 2.

The conventional storage apparatus 1100 shown in Fig. 1 is provided with a control unit 1110 and a  
10 drive unit 1120. In the embodiment shown in Fig. 1, the control unit 1110 is arranged in the center, and the drive units 1120 are arranged in the right and left of the control unit 1110.

The control unit 1110 controls an entire of  
15 the storage apparatus 1100. A logic portion 1420 controlling the entire of the storage apparatus 1100 is received in the control unit 1110, details thereof being described later. Further, a disc drive 1310 for storing data is received in the drive unit 1120. In  
20 the case of enlarging the scale of the storage apparatus 1100, the drive unit 1120 is added. Accordingly, it is possible to flexibly change a storage capacity of the storage apparatus 1100 in correspondence to the user's needs, and it is possible  
25 to provide the storage apparatus 1100 having a high scalability. As the disc drive 1310, it is possible to employ various apparatuses, for example, a hard disc



device, a semiconductor memory device and the like.

On the other hand, the conventional storage apparatus 1100 shown in Fig. 2 is provided with an all-in-one unit 1130 in which the logic portion 1420  
5 controlling the entire, and the disc drive 1310 for storing the data are received. The storage apparatus 1100 having the structure shown in Fig. 2 is structured such that minimum functions for the storage apparatus 1100 are received in one casing. Fig. 2 shows a view  
10 in the case that the storage apparatus 1100 is seen from a side in which the logic portion 1420 is received. The disc drive 1310 is received in an opposite side to the logic portion 1420. In the following description, the side in which the logic  
15 portion 1420 is received is also called as a front face side. Further, the side in which the disc drive 1310 is received is also called as a rear face side.

Next, a description will be given below of a detailed structure of each of the conventional storage  
20 apparatuses 1100 shown in Figs. 1 and 2 with reference to six-elevational views and front elevational views shown in Figs. 3 to 6. Fig. 3 is a six-elevational view showing the control unit 1110, Fig. 4 is a six-elevational view showing the drive unit 1120, and Fig.  
25 5 is a six-elevational view showing the all-in-one unit 1130. Fig. 6 is a view for comparing the control unit 1110, the drive unit 1120 and the all-in-one unit 1130.

First, a description will be given of a

structure of the control unit 1110 with reference to Figs. 3 and 6.

The control unit 1110 is structured such that a logic module 1400, a power source module 1900, a fan 1500 and a battery 1800 are received in the control unit casing 1200. Further, an operator panel 1111 for accepting a control input applied by an operator maintaining the storage apparatus 1100 is provided in the control apparatus 1110.

10           The logic module 1400 is detachably received in the control unit casing 1200. The logic module 1400 is provided with the logic portion 1420 for controlling the storage apparatus 1100, and a logic module fan 1410. A logic substrate 1430 is attached to the logic  
15           portion 1420, whereby various controls of the storage apparatus 1100 are executed. The logic substrate 1430 attached to the logic portion 1420 includes, for example, a channel adapter for communicating for inputting and outputting data with respect to the  
20           information processing apparatus utilizing the storage apparatus 1100 as the memory device, a disc adapter for executing an input-output processing with respect to the data stored in the disc drive 1310, a cash memory for storing the data given and received with respect to  
25           the information processing apparatus, and the like. The logic module fan 1410 discharges the air in an inner portion of the logic portion 1420. Accordingly, it is possible to cool the inner portion of the logic

portion 1420. The air discharged from the logic  
portion 1420 is discharged to the outer portion of the  
control unit 1110 through an inner portion of the power  
source module 1900 by a fan 1500, details thereof being  
5 described later.

The power source module 1900 is detachably  
received in the control unit casing 1200. The power  
source module 1900 is provided with a power source unit  
for converting an ac power into a dc power, and  
10 supplying the dc power to the logic module 1400. Since  
it is necessary to supply a plurality of dc powers  
having different voltages to the logic module 1400 in  
correspondence to intended uses, the power source  
module 1900 is provided with the power source units in  
15 correspondence to the respective voltages. For  
example, the power source unit outputting the dc power  
having a rated voltage 12V is provided for the logic  
module fan 1410. Further, the power source units  
outputting the dc powers having rated voltages 5V and  
20 3.3 V are provided for the logic substrate 1430.

The fan 1500 discharges the air in the inner  
portion of the control unit 1110 to the outer portion.  
Accordingly, it is possible to discharge the heat  
generated in the power source module 1900 and the logic  
25 module 1400 to the outer portion of the control unit  
1110.

The battery 1800 corresponds to an auxiliary  
power source module for supplying a power to each of

the devices in the inner portion of the control unit 1110, at a time of a power outage or at an abnormal time of the power source module 1900.

As shown in Fig. 3, the power source module 5 1900, the logic module 1400 and the battery 1800 are respectively received in an upper stage, a middle stage and a lower stage of the control unit casing 1200. Further, in a rear face side of the control unit casing 1200, in the same manner, the power source module 1900, 10 the logic module 1400 and the battery 1800 are respectively received in the upper stage, the middle stage and the lower stage.

Next, a description will be given of the structure of the drive unit 1120 of the conventional 15 storage apparatus 1100 with reference to Figs. 4 and 6.

The drive unit 1120 is structured such that a disc drive module 1300, an AC-BOX 1700 and the fan 1500 are received in a drive unit casing 1210.

The disc drive module 1300 is detachably 20 received in the drive unit casing 1210. The disc drive module 1300 receives a disc drive 1310 for storing the data, a DC power source 1600 and a port bypass circuit (PBC) 1320. The disc drive 1310 corresponds to an apparatus for storing the data, and is provided with a 25 recording medium in an inner portion. The disc drive 1310 can employ various apparatuses, for example, a hard disc device, a semiconductor memory device and the like. The DC power source 1600 corresponds to a power

source unit for converting the ac power into the dc power, and supplying the dc power to the disc drive 1310. The PBC 1320 corresponds to an apparatus for controlling a communication path between the logic  
5 portion 1420 provided in the control unit 1110 and the disc drive 1310.

The AC-BOX 1700 corresponds to an intake for the ac power with respect to the storage apparatus 1100, and functions as a breaker. The ac power taken  
10 in the AC-BOX 1700 is supplied to the DC power source 1600 of the disc drive module 1300, and the power source module 1900 of the control unit 1110.

The fan 1500 discharges the air in the inner portion of the drive unit 1120 to the outer portion.  
15 Accordingly, it is possible to discharge the heat generated in the disc drive module 1300 to the outer portion of the drive unit 1120.

In the embodiment shown in Fig. 4, the disc drive modules 1300 are received in a state of being  
20 laminated in four stages within the drive unit casing 1210. Further, the fan 1500 is provided in an upper portion of the disc drive module 1300, and the AC-BOX 1700 is provided in a lower portion thereof. Further, in a rear face side of the drive unit casing 1210, in  
25 the same manner, the disc drive modules 1300 are received in a state of being laminated in four stages, the fan 1500 is provided in an upper portion thereof, and the AC-BOX 1700 is provided in a lower portion

thereof.

Next, a description will be given of the all-in-one unit 1130 of the conventional storage apparatus 1100 with reference to Figs. 5 and 6.

5           The all-in-one unit 1130 is structured such that the logic module 1400, the power source module 1900, the fan 1500 and the battery 1800 are received in a front face side of an all-in-one unit casing 1220, and the disc drive module 1300, the AC-BOX 1700 and the  
10 fan 1500 are received in a rear face side. The modules are respectively the same as those received in the control unit 1110 and the drive unit 1120. Further, receiving positions of the modules are respectively the same as those in the control unit 1110 and the drive  
15 unit 1120. Further, in the same manner as the control unit 1110 and the drive unit 1120, the respective modules are detachably received in the all-in-one unit casing 1220.

          In the all-in-one unit 1130, since the  
20 respective modules received in the control unit 1110 and the drive unit 1120 are received in the all-in-one unit casing 1220, as mentioned above, the storage apparatus 1100 can be structured by the all-in-one unit 1130.

25           Next, a description will be given of differences among the control unit 1110, the drive unit 1120 and the all-in-one unit 1130 described above with reference to Figs. 6 and 7. In this case, a view shown

in a left side in Fig. 6 illustrates the control unit 1110, and the same matter is applied to the front face side of the all-in-one unit 1130. Further, a view shown in a right side in Fig. 6 illustrates the drive unit 1120, and the same matter is applied to the rear face side of the all-in-one unit 1130. Accordingly, the differences among the control unit 1110, the drive unit 1120 and the all-in-one unit 1130 can be explained by describing the difference between the control unit 1110 and the drive unit 1120 shown in Fig. 6.

The control unit 1110 is largely sectioned into the upper stage, the middle stage and the lower stage. The power source module 1900 is received in the upper stage, the logic module 1400 is received in the middle stage, and the battery 1800 is received in the lower stage. The control unit casing 1200 for receiving the respective modules and the like is provided with an upper partition portion 1201 and a lower partition portion 1202, and the respective modules and the like are received in a sectioned manner by the partition portions.

The drive unit 1120 is structured such that the disc drive modules 1300 are laminated in four stages, the fan 1500 is arranged in the upper portion thereof and the AC-BOX 1700 is arranged in the lower portion thereof. Further, the disc drives 1310 respectively received in the disc drive modules 1300 are received in a state of being laminated in four

stages. The drive unit casing 1210 for receiving the respective modules and the like is provided with an upper partition portion 1211, a middle partition portion 1 (1212), a middle partition portion 2 (1213) and a lower partition portion 1214, and the respective modules and the like are received in a sectioned manner by the partition portions. In this case, in the embodiment shown in Fig. 6, no partition portion is provided between the fan 1500 and the disc drive module 1300, however, the partition portion may be provided.

As shown in Fig. 6, the position of the partition portion is different between the control unit casing 1200 and the drive unit casing 1210. One of the reasons is that a height and a width of the logic module 1400 are respectively different from a height and a width of the disc drive module 1300, as shown in Fig. 7.

Accordingly, in the conventional storage apparatus 1100, it is necessary to manufacture the control unit casing 1200, the drive unit casing 1210 and the all-in-one unit casing 1220 respectively for exclusive use, and it is necessary for the user operating and controlling the storage apparatus 1100 to buy the new casing at a time of changing the structure of the storage apparatus 1100. Accordingly, it is required to make the casings for the storage apparatuses 1100 in common.

In the storage apparatus 100 in accordance



with the present embodiment, a casing for the storage apparatus 100 (a storage apparatus casing) 200 is designed to be in common. First, an outer appearance structure of the storage apparatus 100 in accordance  
5 with the present embodiment is shown in Figs. 8 and 9.

The storage apparatus 100 in accordance with the present embodiment shown in Fig. 8 is provided with a control unit 110 and a drive unit 120. In the embodiment shown in Fig. 8, the control unit 110 is  
10 arranged in the center, and the drive units 120 are arranged in the right and left of the control unit 110.

The control unit 110 controls an entire of the storage apparatus 100. A logic portion 420 controlling the entire of the storage apparatus 100 is  
15 received in the control unit 110, details thereof being described later. Further, a disc drive 310 for storing data is received therein. Further, a DC power source 600, a battery 800 and an AC-BOX 700 are also received therein. A rear face side of the control unit 110 is  
20 structured in the same manner.

On the other hand, the disc drive 310 for storing the data is received in the drive unit 120. Further, the DC power source 600, the battery 800 and the AC-BOX 700 are also received therein. A rear face  
25 side of the drive unit 120 is structured in the same manner. In the case of enlarging the scale of the storage apparatus 100, the drive unit 120 is added. Accordingly, it is possible to flexibly change a memory

capacity of the storage apparatus 100 in correspondence to the user's needs, and it is possible to provide the storage apparatus 100 having a high scalability.

Further, the storage apparatus 100 shown in  
5 Fig. 9 is provided with an all-in-one unit 130 in which the logic portion 420 controlling the entire, the disc drive 310 for storing the data, the DC power source 600, the battery 800, and the AC-BOX 700 are received. The storage apparatus 100 having the structure shown in  
10 Fig. 9 is structured such that minimum functions for the storage apparatus 100 are received within one casing. A rear face side is structured in the same manner. The all-in-one unit 130 in accordance with the present embodiment is structured in the same manner as  
15 the control unit 110 shown in Fig. 8.

Next, a description will be given of the way how the control unit 110, the drive unit 120 and the all-in-one unit 130 are respectively structured by using the common casing 200, with reference to Figs. 10  
20 to 12.

Fig. 10 is a view showing a structure which is in common with the control unit 110, the drive unit 120 and the all-in-one unit 130. In other words, a disc drive module (a disc drive box) 300 in which a  
25 plurality of disc drives 310 are received in a state of being aligned is received in an upper stage (a first receiving portion) of the casing 200, and the battery 800, the AC-BOX 700 and the DC power source 800 are

received in a lower stage (a third receiving portion).  
In this case, the battery 800, the AC-BOX 700 and the  
DC power source 800 correspond to the power source  
portion. Of course, the power source portion may be  
5 structured by at least any one of these elements, or  
may include any other constituting elements than these  
elements. Further, a fan 500 is arranged in an upper  
portion of the disc drive module 300. In the case of  
the control unit 110 or the all-in-one unit 130, a  
10 logic module (a control portion box) 400 is received in  
a middle stage (a second receiving portion), and in the  
case of the drive unit 120, the disc drive module 300  
is received in the middle stage.

As mentioned above, a height and a width of  
15 the upper stage of the casing 200 are respectively  
formed so as to be approximately equal to the height  
and the width of the disc drive module 300, so that the  
disc drive module 300 can be received in the upper  
stage.

20 In this case, the disc drive module 300 in  
the upper stage is detachably received in the casing  
200. Further, the disc drive 310 is detachably  
received in the disc drive module 300. The battery  
800, the AC-BOX 700 and the DC power source 800 in the  
25 lower stage are detachably received in the casing 200.

The upper stage, the middle stage and the  
lower stage of the casing 200 are sectioned by an upper  
partition portion 201 and a lower partition portion

202.

The control unit 110 and the all-in-one unit 130 can be structured by receiving the logic module 400 in the middle stage of the casing 200. The state is  
5 shown in Fig. 11.

Further, the drive unit 120 can be structured by receiving the disc drive module 300 in the middle stage of the casing 200. The state is shown in Fig. 12. The disc drive module 300 received in the middle  
10 stage of the casing 200 is the same as the disc drive module 300 received in the upper stage of the casing 200.

In the casing 200 in accordance with the present embodiment, the upper stage and the middle  
15 stage are formed such that the heights and the widths are approximately equal to each other, respectively. Accordingly, not only the logic module 400, but also the disc drive module 300 can be received in the middle stage.

20 Accordingly, for example, in the case of enlarging the scale of the storage apparatus 100, the casing 200 which is used for the all-in-one unit 130 can be utilized for the drive unit 120. In this case, Figs. 11 and 12 shows the embodiment in the case that  
25 both of the logic module 400 and the disc drive module 300 can be received in the middle stage of the casing 200, however, the structure may be made such that both the modules can be received in the upper stage in

addition to the middle stage of the casing 200.

Further, the structure can be made such that only the middle stage or only the upper stage can receive both the modules.

5           As mentioned above, in the present embodiment, each of the control unit 110, the drive unit 120 and the all-in-one unit 130 can be structured by using the common casing 200.

          In the storage apparatus 100 in accordance  
10 with the present embodiment, Fig. 13 shows the structure in which the upper stage and the middle stage of the casing 200 are formed such that the heights and the widths are approximately equal to each other. Further, Fig. 14 shows a view for comparing the heights  
15 and the widths of the logic module 400 and the disc drive module 300. Further, Fig. 15 shows a six-elevational view illustrating a detailed structure of the control unit 110 and the all-in-one unit 130. Further, Fig. 16 shows a six-elevational view  
20 illustrating a detailed structure of the drive unit 120.

          First, a description will be given of the structures of the control unit 110 and the all-in-one unit 130 in accordance with the present embodiment,  
25 with reference to Figs. 13 to 15.

          The control unit 110 and the all-in-one unit 130 are structured such that the logic module 400, the disc drive module 300, the DC power source 600, the AC-

BOX 700, the battery 800 and the fan 500 are received in the casing 200. Further, the control unit 110 and the all-in-one unit 130 are provided with an operator panel 111 for accepting a control input applied by an  
5 operator maintaining the storage apparatus 100.

As described by using Fig. 11, the logic module 400 is detachably received in the casing 200. The logic module 400 is provided with the logic portion 420 for controlling the storage apparatus 100, and a  
10 logic module fan 410. A logic substrate (a control board for executing a control relating to a data inputting and outputting process with respect to the disc drive) 430 is received in the logic portion 420 detachably in a aligned manner, whereby various  
15 controls of the storage apparatus 100 are executed. The logic substrate 430 received in the logic portion 420 includes, for example, a channel adapter for communicating for inputting and outputting data with respect to the information processing apparatus  
20 utilizing the storage apparatus 100 as the memory device, a disc adapter for executing an input-output processing with respect to the data stored in the disc drive 310, a cash memory for storing the data given and received with respect to the information processing  
25 apparatus, and the like. In this case, the logic substrates 430 are not only received in the logic portion 420 in such a manner that all of the logic substrates 430 are aligned in the same direction, as

shown in Fig. 13 or 11, but also can be received, for example, in such a manner that the logic substrate 430 aligned in a vertical direction and the logic substrate 430 aligned in a horizontal direction are mixed.

5           The logic module fan 410 discharges the air in an inner portion of the logic portion 420. Accordingly, it is possible to cool the inner portion of the logic portion 420. The air discharged from the logic portion 420 is discharged to the outer portion of  
10 the control unit 110 and the all-in-one unit 130 through an inner portion of an air duct (a duct) 210 provided in the inner portion of the casing 200, by a fan 500, details thereof being described later.

          The disc drive module 300 is detachably  
15 received in the casing 200. The disc drive module 300 receives a disc drive 310 for storing the data. The disc drive 310 corresponds to an apparatus for storing the data, and is provided with a recording medium in an inner portion. The disc drive 310 can employ various  
20 apparatuses, for example, a hard disc device, a semiconductor memory device and the like. As shown in Fig. 13, the disc drives 310 are received in the disc drive module 300 in accordance with the present embodiment in a state in which the disc drives 310 are  
25 laminated in eight stages. Accordingly, the height of the disc drive module 300 in accordance with the present embodiment can be made approximately the same as the height of the logic module 400.

The fan 500 discharges the air in the inner portion of the control unit 110 or the all-in-one unit 130 to the outer portion. Accordingly, it is possible to discharge the heat generated in the disc drive  
5 module 300 and the logic module 400 to the outer portion of the control unit 110 and the all-in-one unit 130. In this case, the control unit 110 and the all-in-one unit 130 are provided with the air duct 210 in the inner portion thereof, details thereof being  
10 mentioned later. The air in the inner portion of the logic module 400 received in the middle stage of the casing 200 is discharged to the outer portion of the control unit 110 and the all-in-one unit 130 through the inner portion of the air duct 210 by the fan 500.

15 The DC power source 600, the AC-BOX 700 and the battery 800 are received in the lower portion (the third receiving portion) of the casing 200 (the DC power source 600, the AC-BOX 700 and the battery 800 correspond to the power source portion). The power  
20 source portion is detachably received in the casing 200. The DC power source 600 is provided with a power source unit for converting the ac power to the dc power and supplying the dc power to the logic module 400 and the disc drive 310. The logic module 400 and the disc  
25 drive 310 are respectively actuated by the dc powers having the different voltages, in the same manner as that of the conventional storage apparatus 1100, however, in the present embodiment, the dc power having



the same rated voltage is supplied from the DC power source 600 to the logic module 400 and the disc drive 310. Further, the logic module 400 and the disc drive 310 to which the power having the same voltage is  
5 supplied respectively convert the voltage into their respective voltages by a voltage converting apparatus (a DC/DC converter) provided in the inner portion thereof.

Further, in the control unit 110 and the all-  
10 in-one unit 130 in accordance with the present embodiment, the DC power source 600 for supplying the dc power to the disc drive 310 is received in the lower stage of the casing 200. Accordingly, since the DC power source 1600 which is conventionally received in  
15 the disc drive module 1300 can be removed from the disc drive module 1300, it is possible to make the width of the disc drive module 300 approximately equal to the width of the logic module 400 in accordance with the present embodiment,

20 The battery 800 corresponds to an auxiliary power source apparatus for supplying the power to each of the devices in the inner portion of the control unit 110 and the all-in-one unit 130 at a time of a power outage or at an abnormal time of the DC power source  
25 600.

The AC-BOX 700 corresponds to an intake for the ac power with respect to the storage apparatus 100, and functions as a breaker. The ac power taken in the

AC-BOX 700 is supplied to the DC power source 600.

As mentioned above, in the control unit 110 and the all-in-one unit 130 in accordance with the present embodiment, the power source portions are put  
5 together in the lower portion of the casing 200.

Accordingly, it is unnecessary to arrange the wiring for the ac power in the inner portions of the control unit 110 and the all-in-one unit 130.

Further, since the voltage converting  
10 apparatus is provided in the inner portions of the logic module 400 and the disc drive 300, it is unnecessary to arrange the wiring for supplying the ac powers having the different voltages in the inner portions of the control unit 110 and the all-in-one  
15 unit 130. Accordingly, it is possible to simplify the wire arrangement within the casing 200, and it is possible to make manufacturing, maintaining and repairing the storage apparatus 100 easy and improve a safety. Further, since it is possible to make it hard  
20 to be exposed to the influence with respect to the noise, it is possible to improve a reliability of the storage apparatus 100.

A state thereof will be shown in Figs. 25 to 28. Figs. 25 to 28 are views showing a state in which  
25 the powers having a plurality of rated voltages are supplied from the power source module 1900 to the logic module 1400, in the conventional all-in-one unit 1130. In this case, Figs. 25 and 26 show an embodiment of the

case of the all-in-one unit 1130, however, the same matter is applied to the control unit 1110.

As shown in Fig. 26, the power is supplied from the power source module 1900 to the logic module 1400 by connecting a power source module substrate 1910 to a logic module substrate 1440 by a bus bar 1610. The bus bar 1610 corresponds to a metal plate for supplying the power from the power source module 1900 to the logic module 1400. Since the great power is supplied from the power source module 1900 to the logic module 1400, a current-carrying capacity comes short in the normal wire harness. Accordingly, the power is supplied by employing the metal plate such as the bus bar 1610. The power source module substrate 1910 is arranged in the innermost side of the upper stage of the all-in-one unit casing 1220 together with a power source module reinforcing plate 1920. In the case of the control unit casing 1200, the power source module substrate 1910 is arranged in a rear face side in the same manner in addition to the front face side. When the power source module 1900 is received in the all-in-one unit casing 1220, an electric connector provided in the power source module 1900 is fitted to an electric connector provided in the power source module substrate 1910. On the other hand, the logic module substrate 1440 is arranged in the innermost side in the middle stage of the all-in-one unit casing 1220 together with a logic module reinforcing plate 1450. In the case of

the control unit casing 1200, the logic module substrate 1440 is arranged in a rear face side in the same manner in addition to the front face side. When the logic module 1400 is received in the all-in-one unit casing 1220, an electric connector provided in the logic module 1400 is fitted to an electric connector provided in the logic module substrate 1440. As mentioned above, it is possible to electrically connect the power source module 1900 and the logic module 1400 to each other. Further, it is possible to supply the power from the power source module 1900 to the logic module 1400. As mentioned above, it is conventionally necessary to supply a plurality of voltages to the logic module 1400. Accordingly, as shown in Fig. 26, the kinds and the number of the bus bar 1610 for connecting the power source module substrate 1910 to the logic module substrate 1440 are increased, and the arrangement of the bus bar 1610 is required to be designed. As shown in Fig. 26, there is a case that it is necessary to arrange the long bus bar 1610 up to the side surface portion between the power source module substrate 1910 and the logic module substrate 1440.

Fig. 25 shows a state in which the power source module 1900 and the logic module 1400 are connected therebetween by the bus bar 1610 in the inner portion of the conventional all-in-one unit 1130. As shown in Fig. 25, in the conventional all-in-one unit 1130, the power source module 1900 is received in the

upper stage of the all-in-one unit casing 1220, and the logic module 1400 is received in the middle stage.

Accordingly, since there is established a positional relation that the logic module fan 1410 is arranged

5 between the power source module 1900 and the logic module 1400, it is unavoidable that the length of the bus bar 1610 is increased at such a degree that the logic module fan 1410 is held therebetween.

On the other hand, in the all-in-one unit 130  
10 in accordance with the present embodiment, the DC power source 600 is received in the lower stage of the casing 200, and the logic module 400 is received in the middle stage thereof. In the all-in-one unit 130 in accordance with the present embodiment, the power is  
15 supplied from the DC power source 600 to the logic module 400 by using the bus bar 610. However, since the DC power source 600 is received in the lower portion of the logic module 400, as shown in Fig. 27, it is possible to avoid the positional relation that  
20 the logic module fan 410 is arranged between the logic module 400 and the DC power source 600. Accordingly, it is possible to shorten the length of the bus bar 610.

Further, as shown in Fig. 28, in the all-in-  
25 one unit 130 in accordance with the present embodiment, a logic module substrate 440 and a DC power source substrate 910 are connected therebetween by the bus bar 610. Further, the DC power source substrate 910 is

arranged in the innermost side of the lower stage of the casing 200 together with a DC power source reinforcing plate 920. The DC power source substrate 910 is arranged in a rear face side in the same manner in addition to the front face side. Further, when the DC power source 600 is received in the casing 200, the electric connector provided in the DC power source 600 is fitted to the electric connector provided in the power source substrate 1910. On the other hand, the logic module substrate 440 is arranged in the innermost side of the middle stage of the casing 200 together with a logic module reinforcing plate 450. The logic module substrate 440 is arranged in a rear face side in the same manner in addition to the front face side. Further, when the logic module 400 is received in the casing 200, the electric connector provided in the logic module 400 is fitted to the electric connector provided in the logic module substrate 440. In the manner mentioned above, the DC power source 600 and the logic module 400 are electrically connected to each other. Further, the power is supplied from the DC power source 600 to the logic module 400.

As shown in Figs. 27 and 28, in the present embodiment, the number of the bus bar 610 can be reduced in comparison with the conventional one. Further, the length of the buss bar 610 can be shortened. This is because in the storage apparatus 100 in accordance with the present embodiment, the

voltage of the dc power supplied from the DC power source 600 to the logic module 400 is set to one kind, and the DC power source 600 is received in the lower portion of the logic module 400, as mentioned above.

5           Next, a description will be given of a structure of the drive unit 120 in accordance with the present embodiment with reference to Figs. 13 to 16.

          The drive unit 120 is structured such that the disc drive module 300, the DC power source 600, the  
10 AC-BOX 700, the battery 800 and the fan 500 are received in the casing 300. The respective modules and the like are the same as those employed in the control unit 110 and the all-in-one unit 130. In the storage apparatus 100 in accordance with the present  
15 embodiment, all of the control unit 110, the drive unit 120 and the all-in-one unit 130 are structured by using the common casing 200. Further, in the drive unit 120, the disc drive module 300 can be received in the middle stage of the casing 200 in which the logic module 400  
20 is received in the control unit 110. This is because in the present embodiment, the height and the width of the logic module 400 can be made approximately equal to the height and the width of the disc drive module 300, and the upper stage and the middle stage of the casing  
25 200 can be made approximately equal to each other in the height and the width, as mentioned above.

          The fan 500 sucks the air in the inner portion of the disc drive modules 300 which are

respectively received in the upper stage and the middle stage of the casing 200, and discharges the air to the outer portion of the drive unit 120. Accordingly, it is possible to discharge the heat generated from the disc drive 310 received in the disc drive module 300 to the outer portion of the drive unit 120. In this case, the drive unit 120 is provided with the air duct 210 in the inner portion of the casing 200, and the air in the inner portion of the disc drive module 300 received in the middle stage of the casing 200 is discharged to the outer portion of the drive unit 120 through the inner portion of the air duct 210 by the fan 500.

A description will be given of a cooling structure of the storage apparatus 100 in accordance with the present embodiment with reference to Figs. 17 to 24.

First, a description will be given of the cooling structure of the conventional storage apparatus 1100 with reference to Figs. 17 and 18. Fig. 17 shows a cooling structure of the all-in-one unit 1130 of the conventional storage apparatus 1100. Fig. 18 shows a cooling structure of the drive unit 1120 of the conventional storage apparatus 1100. Arrows described in Figs. 17 and 18 show a flow state of a cooling wind. The same matter is applied to the other drawings. The cooling structure of the control unit 1110 is the same as the cooling structure in the logic portion 1420 and the power module 1900 of the all-in-one unit 1130.



The all-in-one unit 1130 is structured such that the logic portion 1420, the logic module fan 1410, the power source module 1900, the battery 1800 and the fan 1500 are received in the front face side, and the  
5 disc drive module 1300, the AC-BOX 1700, and the fan 1500 are received in the rear face side.

The front face side of the all-in-one unit 1130 is cooled by discharging the air in the inner portion of the logic portion 1420 and the power source  
10 module 1900 to the outer portion of the all-in-one unit 1130, by means of the fan 1500 and the logic module fan 1410. In other words, the air in the inner portion of the logic portion 1420 is sucked by the logic module fan 1410, and is discharged to the outer portion of the  
15 all-in-one unit 1130 together with the air in the inner portion of the power source module 1900 by the fan 1500.

The rear face side of the all-in-one unit 1130 is cooled by discharging the air in the inner  
20 portion of the disc drive module 1300 to the outer portion of the all-in-one unit 1130, by means of the fan 1500. In other words, the air in the inner portion of the disc drive module 1300 is discharged to the outer portion of the all-in-one unit 1130 through the  
25 space formed between the disc drive module 1300 and the logic module 1400 or the power source module 1900 by the fan 1500, in the inner portion of the all-in-one unit casing 1220, as shown in Fig 17.

The drive unit 1120 is cooled in the same manner as that of the rear face side of the all-in-one unit 1130, as shown in Fig. 18. In other words, the air in the inner portion of the disc drive module 1300 is discharged to the outer portion through the space formed between the disc drive module 1300 in the front face side and the disc drive module 1300 in the rear face side by the fan 1500, in the inner portion of the drive unit casing 1230, as shown in Fig 18.

Next, a description will be given of a cooling structure of the storage apparatus 100 in accordance with the present embodiment with reference to Figs. 19 to 24. Figs. 19 to 21 are views for explaining a cooling structure of the control unit 110 or the all-in-one unit 130. Fig. 22 is a view for explaining a cooling structure of the drive unit 120.

The control unit 110 or the all-in-one unit 130 in accordance with the present embodiment is provided with the fan 500, the disc drive module 300, the logic portion 420, the logic module fan 410, and the power source portion (the DC power source 600, the AC-BOX 700 and the battery 800). The control unit 110 and the all-in-one unit 130 are cooled by discharging the air in the inner portion of the control unit 110 and the all-in-one unit 130 to the outer portion, by means of the fan 500 and the logic module fan 410. At this time, it is desirable in view of an improvement of cooling efficiency that the air in the inner portion of

the casing 200 is discharged to the outer portion as smooth as possible. In the control unit 110 and the all-in-one unit 130 in accordance with the present embodiment, the disc drive module 300 is received in the upper stage, the logic module 400 is received in the middle stage, and the power source portion is received in the lower stage. In the control unit 110 and the all-in-one unit 130 in accordance with the present embodiment, it is possible to improve an exhaust efficiency on the basis of the arrangement mentioned above.

In other words, as shown in Fig. 19, the disc drive module 300 received in the upper stage of the casing 200 is short in depth in comparison with the logic module 400 and the power source portion. Accordingly, in the case that the disc drive module 300 is received in the casing, it is possible to secure a large space formed between the disc drive module 300 received in the front face side and the disc drive module 300 received in the rear face side.

Accordingly, it is possible to secure a large ventilation path for the cooling wind sucked by the fan 500. In other words, it is possible to efficiently discharge the air in the inner portion of the casing 200 to the outer portion.

Further, as shown in Fig. 19, the power source portion received in the lower stage of the casing 200 is long in depth in comparison with the disc

drive module 300 and the logic module 400.

Accordingly, in the case that the power source portion is received in the upper stage or the middle stage of the casing 200, the ventilation path for the cooling  
5 wind is closed, however, in the control unit 110 and the all-in-one unit 130 in accordance with the present embodiment, the ventilation path is not closed by receiving the power source portion in the lower stage.

Further, the logic module 400 received in the  
10 middle stage of the casing 200 is short in depth in comparison with the disc drive module 300 received in the upper stage, however, is short in depth in comparison with the power source portion received in the lower stage. Accordingly, it is possible to secure  
15 the space for the ventilation path in the middle stage while securing the large ventilation path in the upper stage of the casing 200 by receiving the logic module 400 in the middle stage of the casing 200. In this case, since the logic module 400 is structured such  
20 that the logic module 400 can ventilate the inner side of the module in a vertical direction, as is different from the disc drive module 300, it is possible to receive the logic module 400 in the front face side and the logic module 400 in the rear face side in such a  
25 manner that the logic module 400 in the front face side and the logic module 400 in the rear face side are arranged close to each other in the inner portion of the casing 200, as shown in Fig. 19. In accordance

with the structure mentioned above, it is possible to efficiently feed the air in the inner portion of the power source portion and the logic module 400 which is sucked by the logic module fan 410, to the ventilation path in the upper stage of the casing 200.

In the case that the cooling structure shown in Fig. 19 is employed, the cooling wind from the disc drive module 300 and the cooling wind from the logic module 400 flow together in the ventilation path in the upper stage of the casing 200. In the case that the flow of the cooling wind gets out of order at a time when the cooling winds flow together, a reduction in the exhaust efficiency is caused. Accordingly, Fig. 20 is a view showing a cooling structure for inhibiting the turbulence generated at a time when the cooling winds flow together. In other words, as shown in Fig. 20, a rectifier fin 211 is arranged within the casing 200. Accordingly, it is possible to inhibit the turbulence of the cooling wind generated at a time when the cooling wind from the disc drive module 300 collides with the cooling wind from the logic module 400. A state in which the rectifier fin 211 is arranged is shown in Fig. 23.

However, even in the case that the rectifier fin 211 is employed, the cooling wind from the disc drive module 300 and the cooling wind from the logic module 400 flow together in due course until reaching the fan 500. A cooling structure shown in Fig. 21 is

provided for the purpose of preventing the cooling wind from the disc drive module 300 and the cooling wind from the logic module 400 from flowing together so as to further increase the exhaust efficiency. In other words, as shown in Fig. 21, the air duct 210 is arranged in the inner portion of the casing 200. A state in which the air duct 210 is arranged is shown in Fig. 24. By arranging the air duct 210 within the casing 200, the cooling wind from the logic module 400 reaches the fan 500 through an inner portion of the air duct 210, and the cooling wind from the disc drive module 300 reaches the fan 500 along an outer wall of the air duct 210. Accordingly, it is possible to prevent the cooling wind from the disc drive module 300 and the cooling wind from the logic module 400 from flowing together. In accordance with the structure mentioned above, it is possible to further increase the exhaust efficiency of the control unit 110 and the all-in-one unit 130. In this case, it is desirable to arrange the upper portion of the air duct 210 and the fan 500 appropriately apart from each other without closely contact with each other. This is because the suction force obtained by the fan 500 with respect to the air in the inner portion of the air duct 210 becomes weak by the closely contact.

Fig. 22 shows the cooling structure in the drive unit 120 in accordance with the present embodiment.

The cooling structure in the drive unit 120 is a structure provided with the air duct 210 in the inner portion, in the same manner as the cooling structure in the control unit 110 and the all-in-one unit 130 shown in Fig. 21. However, the cooling structure is different from the cooling structure in the control unit 110 and the all-in-one unit 130, in a point that the disc drive module 300 is received in the middle stage. In this case, the cooling wind from the disc drive module 300 in the middle stage is discharged to the outer portion of the drive unit 120 through the inner portion of the air duct 210. Further, the cooling wind from the disc drive module 300 in the upper stage is discharged to the outer portion of the drive unit 120 along the outer wall of the air duct 210. As mentioned above, in the drive unit 120, by arranging the air duct 210 in the casing 200, it is possible to discharge the cooling wind from the disc drive module 300 in the upper stage and the cooling wind from the disc drive module 300 and the power source portion in the middle stage and the lower stage without flowing together. Accordingly, in the drive unit 120, it is possible to efficiently cool in the same manner as the control unit 110 and the all-in-one unit 130.

As described above, in the storage apparatus in accordance with the present embodiment, it is possible to make the casing for structuring the control

unit, the drive unit and the all-in-one unit in common. Accordingly, it is possible to easily structure and change the storage apparatus in correspondence to the user's needs. Further, it is possible to make the  
5 parts used at a time of manufacturing the storage apparatus in common and it is possible to easily manufacture and reduce the cost.

Further, since the power source portion is received in the lower portion of the casing, it is  
10 possible to remove a necessity of arranging the wiring for the ac power in the inner portion of the casing. Further, since the voltage of the dc power supplied from the power source portion to the logic module can be made one kind, it is possible to remove a necessity  
15 of arranging the wiring for supplying the dc powers having the different voltages in the inner portion of the casing. Accordingly, it is possible to simplify the wire arranging within the casing, and it is possible to easily manufacture, maintain and repair the  
20 storage apparatus and it is possible to improve a safety. Further, since it is possible to make it hard to be exposed to the influence with respect to the noise, it is possible to improve a reliability of the storage apparatus. Further, it is possible to reduce  
25 the kinds and the number of the bus bar used for supplying the power from the power source portion to the logic module, and it is possible to make the length short. Accordingly, it is possible to reduce the



number of the parts constituting the storage apparatus, and it is possible to achieve easy maintenance and repair of the storage apparatus and an improvement of an assembling operability.

5           The description is given above of the present embodiments, however, the embodiments mentioned above are provided for making the understanding of the present invention easy, and do not limit the present invention.

10           It should be further understood by those skilled in the art that the foregoing description has been made on embodiments of the invention and that various changes and modifications may be made in the invention without departing from the spirit of the  
15 invention and the scope of the appended claims.

          The present invention can provide the casing for the storage apparatus and the storage apparatus.